Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

American Woods

July 1945

Birch

Forest Service

U. S. DEPARTMENT OF AGRICULTURE

BIRCH

By H. S. Betts, *senior engineer, Division of Forest Products*

Between 15 and 20 species and varieties of birch grow in the United States. Of these, yellow birch is by far the most abundant and the most important commercially and probably makes up about two-thirds of the total stand of birch saw timber in the United States. Sweet birch ranks next, followed by paper birch. The remaining birches are of comparatively little importance and their use is largely local.

Yellow birch, sweet birch, and paper birch grow principally in the Northeastern States, Lake States, and southern Appalachian Mountains. Yellow birch and sweet birch are slow-growing, long-lived trees, and under favorable conditions exceptional trees reach a height of 80 to 100 feet and diameter of 3 feet. Paper birch is a comparatively short-lived, small tree.

Yellow birch and sweet birch are cut and sold without distinction simply as "birch." Both are beautiful woods with reddish brown heartwood. The higher grades are much used in the manufacture of furniture, interior finish, doors, and woodenware of various kinds. The less valuable material is used principally for boxes. Sweet birch is somewhat heavier and stronger than yellow birch and darker in color. It is frequently stained to represent mahogany and black walnut, although the rise in the price of sweet birch has made substitution less profitable than formerly. Birch lumber is marketed according to color. Lumber cut from the heartwood of the tree is known as "red birch," and that from the sapwood as "sap birch." Lumber classed as "unselected birch" may include both "red birch" and "sap birch" as well as pieces which contain both heartwood and sapwood. The wood of paper birch (frequently known as "white birch") has a uniform texture and white color, and is especially suited to the manufacture of spools and other products turned on a lathe.

The birches reproduce both from seed and from stump sprouts. Plenty of shade and moisture are necessary for the best reproduction of sweet birch and yellow birch. Paper birch, however, requires abundance of light.

Nomenclature.—Following are the names of the three birches of greatest commercial importance:

Common name	*Botanical name*	*Other names*
Yellow birch	*Betula lutea*	Silver birch. Gray birch. Swamp birch.
Sweet birch	*Betula lenta*	Black birch. Cherry birch. River birch. Mahogany birch.
Paper birch	*Betula papyrifera*	White birch. Canoe birch. Silver birch.

Other birches of slight commercial importance are: River birch (*Betula nigra*), gray birch (*Betula populifolia*), and western paper birch (*Betula papyrifera occidentalis*).

Distribution and growth.—In the United States yellow birch grows in the Lake States, New England, New York, New Jersey, Pennsylvania, and southward along the Appalachian Mountain Ranges into southern Georgia (fig. 1). It reaches its best development near the Canadian border, where mature trees commonly reach a height of 60 to 80 feet and diameter of 1.5 to 3 feet. Forest-grown trees develop tall, clean trunks. Yellow birch often takes 150 years to grow to a size large enough for saw timber. Trees 50 years old average about 5 inches in diameter and 40 feet in height and trees 100 years old about 10 inches in diameter and 65 feet in height. Yellow birch produces seed in abundance. The seed germinates best in an old forest where there is plenty of shade and moss. Moss-covered logs and rocks buried in moss are favorite germinating places.

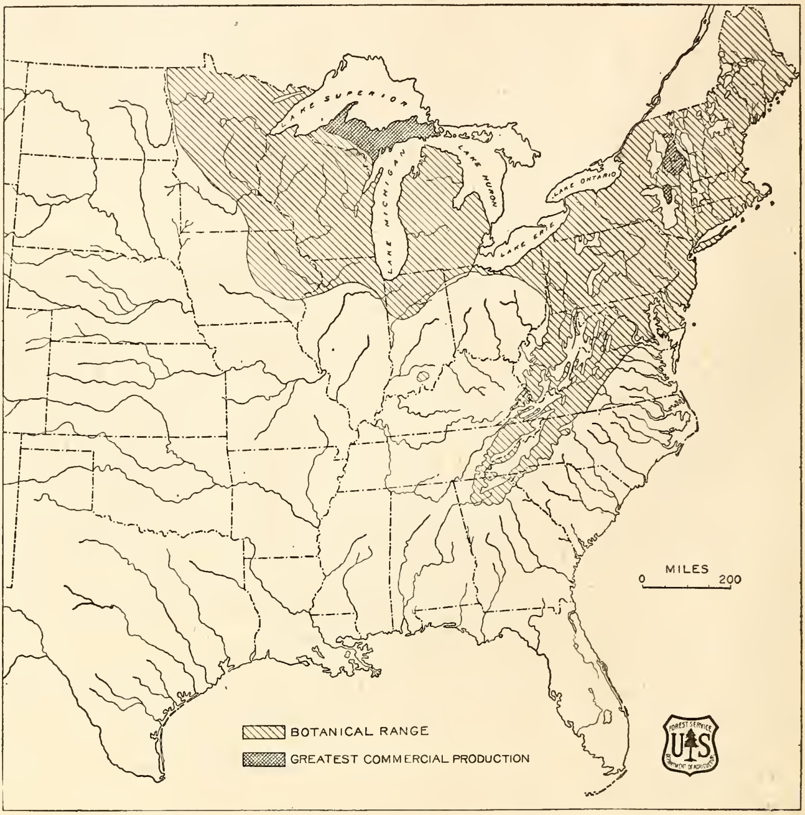

Figure 1.—Range of yellow birch (*Betula lutea*).

Sweet birch grows in Canada in mixed stands from Newfoundland to Ontario, and in the United States in New England, New York, New Jersey, and Pennsylvania, and southward in a narrowing area along the Appalachian Mountains to northern Georgia and Alabama (fig. 2). It also grows in scattered areas in southern Michigan. It is most abundant in the North, but reaches its largest size in the southern Appalachian Mountains. Sweet birch grows even more slowly than yellow birch, and the outlook for a continuous crop is not very promising.

Paper birch—the most widely distributed of the birches—grows from New England and Labrador westward to the Rocky Mountains. In the United States it grows chiefly in New England, New York, Pennsylvania, and the Lake States. (See fig. 3.) West of the Lake States it is comparatively rare. Paper birch is found scattered through forests made up mainly of other trees and in pure stands. Young trees require an abundance of light, and the best stands are generally on burned-over or cut-over areas, where a growth of 8 inches in diameter in 30 years is not uncommon. After that, the rate of growth gradually decreases. Under average conditions paper birch reaches a height of 70 to 80 feet and a diameter of 9 to 10 inches in 65 years. Trees of this size are considered mature, although very old trees frequently reach a diameter of 20 inches. Paper birch seldom lives more than 150 years.

Supply.—A forest survey of the Lake States completed in 1938[1] showed a stand of yellow birch saw timber of 5,252,000,000 board feet, over half of which was in Michigan, and a stand of paper birch saw timber of 1,288,000,000 board feet located largely in Minnesota. Since this survey was made, considerable yellow birch has been cut in excess of growth, and the stand in the Lake States in 1942 was placed at 3,913,000,000 board feet[2] or about 75 percent of the original figure. A proportional reduction in the stand of paper birch would make the present stand approximately 966,000,000 board feet. The amount of yellow birch saw timber in the Northeast and in the Appalachian region probably exceeds that in the Lake States, but much of it may not equal the Lake States material in accessibility and quality. The total stand of yellow birch saw timber in the United States is estimated at 10,000,000,000 board feet. As to the other two birches of principal commercial importance (sweet birch and paper birch), a rough estimate for their combined stand of saw-timber size would be 4,000,000,00 board feet. There is more paper birch in the Northeast than in the Lake States.

Production of lumber.—The production of birch lumber increased from 183,548,000 board feet in 1899[3] to a maximum of 452,370,000 board feet in 1909. (See fig. 4.) After 1909 there was an irregular but not a marked drop until 1929, when a rapid decline began. In 1932 a low point of 72,730,000 board feet was reached. In 1942 production amounted to 214,734,000 board feet. The average annual cut of birch lumber for the 10-year period 1933–42 was 166,200,000 board feet. Production in 1943 was 188,342,000 board feet.

Wisconsin and Michigan have been the two leading States in the production of birch lumber since 1909, while Maine, New York, New Hampshire, and Vermont competed for third place. During the 10-year period 1933–42 about 57 percent of the birch lumber produced came from Wisconsin and Michigan. Probably 75 percent is yellow birch, and 20 percent sweet birch and paper birch about equally divided.

---

[1] Conducted by the Lake States Forest Experiment Station of the Forest Service, U. S. Department of Agriculture, as part of a Forest Survey of the United States.

[2] Findings of the Lake States Forest Experiment Station.

[3] The earliest year for which the production of birch lumber was recorded separately.

Veneer.—The amount of birch used for veneer has varied from a minimum of 12,643,000 board feet log scale in 1905 [4] to a maximum of 75,769,000 feet in 1943. During the period 1905–11 birch furnished between 5 and 6 percent of the total quantity of wood used for veneer and ranked about seventh among the veneer woods in order of quantity. In 1919 and 1921 it furnished between 9 and 10 percent of the total veneer and ranked third. The average consumption of birch for veneer in recent years [5] has been about 32,000,000 feet log scale, equivalent to approximately 38,000,000 feet.[6] Birch consumption in 1939 was 34,012,000 feet log scale, which was about 3 percent of the total amount of wood used for veneer and, made birch rank eighth. The huge demand for aircraft veneer resulted in the consumption of 75,769,000 board feet log scale in 1943 and 63,808,000 feet log scale in 1944. The veneer used in the British "Mosquito" bomber is nearly all birch.

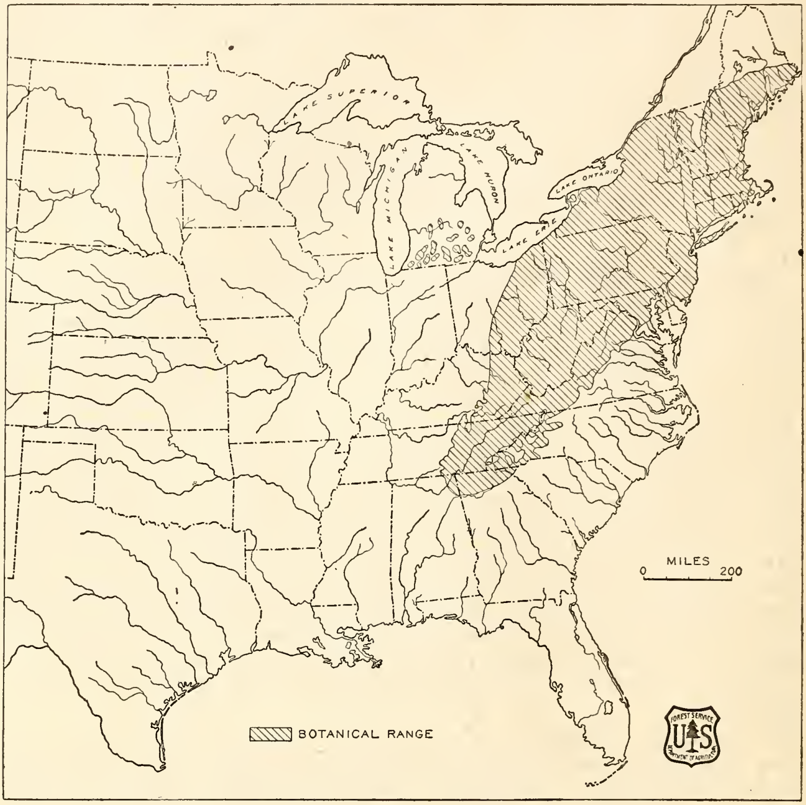

FIGURE 2.—Range of sweet birch (*Betula lenta*).

---

[4] Earliest year for which statistics are available.
[5] Years averaged—1929, 1931, 1935, 1937, and 1939.
[6] The overrun in log scale is taken as 20 percent.

Distillation.—In the hardwood distillation industry maple, birch, and beech are the principal woods used. The products obtained are methanol (wood alcohol), acetate of lime, and charcoal. The average annual consumption of all hardwoods for distillation in the 11-year period 1919–29 [7] was 866,062 cords. Consumption in 1937 was placed at 570,000 cords.[8] Probably about 114,000 cords of this (20 percent), equivalent to approximately 34,200,000 board feet, was birch.[9]

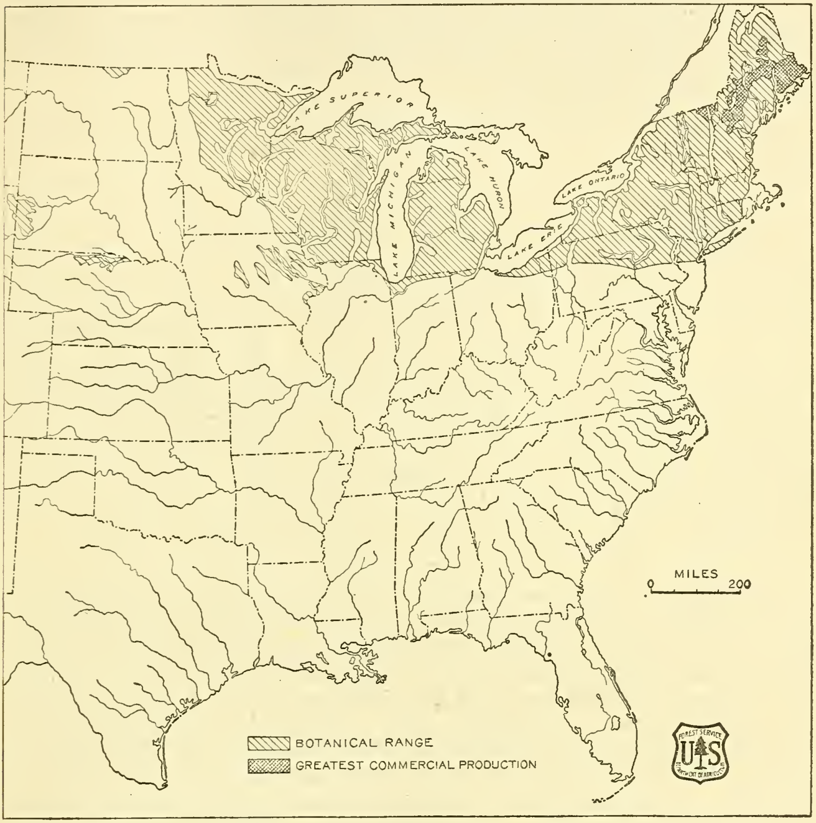

FIGURE 3.—Range of paper birch (*Betula papyrifera*).

Cross ties.—Birch cross ties may be hewed or sawed. Some are given a preservative treatment before use to make them resistant to decay, and some are used without treatment. The number of birch cross ties treated at wood-preserving plants has varied from a minimum of 174,000 in 1915 to a maximum of 2,761,000 in 1929. The average number treated annually for the 10-year period 1931–40 was about 1,000,000. If it is assumed that 75 percent of the birch ties are treated, the total of all birch ties used annually would be 1,333,000. If it is also assumed that one-half these ties are hewed and one-half sawed,[10] then the average annual consumption of hewed birch ties would be equivalent to approximately 20,000,000 board feet.

---

[7] The latest year for which the consumption by cords is given by the Bureau of the Census.

[8] See HAERTEL, H. M. TIMBER REQUIREMENTS OF THE HARDWOOD DISTILLATION INDUSTRY. U. S. Forest Serv. Progress Rpt. Forest Survey, Requirements Phase, 64 pp. 1938. [Processed.]

[9] One cord of distillation wood is considered to contain 300 board feet.

Pulpwood.—In the statistics [11] showing the annual consumption of pulpwood birch, beech, and maple are grouped together. Consumption of these woods for the 10-year period 1931–40 varied from a minimum of 65,958 cords in 1932 to an all-time maximum of 298,895 cords in 1940 with an average annual consumption of 154,932 cords. If it is assumed that birch furnished one-third of this, the average annual consumption of birch pulpwood would be 51,644 cords, equivalent to approximately 15,493,000 board feet.[12] An unofficial estimate for 1944 is 27,000 cords.

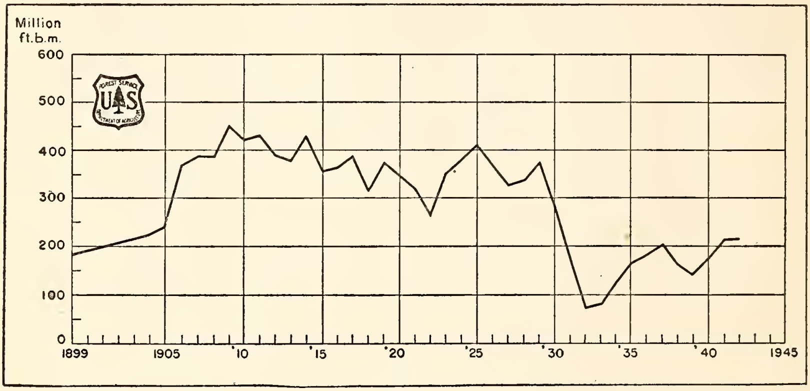

FIGURE 4.—Lumber production of birch (Betula species), 1899–1942.

Cooperage.—Birch was formerly used in considerable quantities in the manufacture of staves for slack barrels for shipping cement, flour, sugar, crackers, etc. In 1909 a maximum of 78,897,000 birch staves was produced, equivalent to about 26,000,000 board feet.[13] In 1925, the last year in which statistics for birch staves are listed separately, only 8,798,000 staves were produced. Birch was also used to some extent for heading for slack barrels but has fallen off markedly for this use. Small quantities were also used in the past in the production of staves and heading for tight barrels for the shipment of liquids such as oils, molasses, etc. In recent years probably not more than the equivalent of 5,000,000 board feet of birch has been used annually for cooperage purposes, very largely staves for slack barrels.[14]

The total annual cut of the three commercially important birches in recent years is roughly estimated at 310,000,000 board feet, including an allowance of 100,000 cords for fuel wood.[15]

Properties.—The wood of both yellow and sweet birch is heavy,[16] hard, stiff, and strong, and has high shock-resisting ability. Sweet birch is slightly above yellow birch in most of its strength properties. Yellow birch has white sapwood—generally several inches in width—and light reddish brown heartwood. Sweet birch has white or pale-yellow sapwood and reddish brown heartwood, somewhat darker than the heartwood of yellow birch and tinged with red. The wood of both has a close, uniform texture and is capable of taking a beautiful polish.

---

[10] Sawed birch ties are classed as lumber and are included in the figures covering the production of lumber.

[11] Bureau of the Census.

[12] A cord of birch pulpwood is considered to contain 300 board feet.

[13] Three slack staves are considered equivalent to 1 board foot.

[14] Containers that compete with slack barrels include cloth and paper bags, a wide variety of fiberboard boxes, wooden boxes and crates, and plywood containers.

[15] A cord of birch pulpwood or fuel wood is considered to contain 300 board feet.

[16] The average weight of yellow birch in a thoroughly air-dry condition (12 percent moisture) is 43 pounds per cubic foot and that of sweet birch 46 pounds per cubic foot.

The wood of paper birch is also uniform in texture but is not so heavy[17] as that of the other two birches and ranks considerably below them in hardness, strength, and stiffness. Paper birch can be readily turned in a lathe, presenting a smooth, white surface. The white sapwood is generally from 2 to 4 inches thick in mature trees. Rapidly grown timber up to 10 inches in diameter is frequently made up almost entirely of sapwood. Paper birch is subject to a serious defect known as "red heart" which frequently affects about 15 percent of the trees in mature stands.

None of the three commercial birches is durable in contact with the ground. In this respect they are classed with spruce, hemlock, ash, hickory, and sugar maple. The birches shrink considerably in drying and the seasoning process must be carefully conducted to prevent checking and warping. They are among the hardwoods that are rather difficult to pulp. They are commonly pulped by the soda process[18] and yield a comparatively short-fibered pulp.

Principal uses.—Birch is used principally for lumber, veneer, distillation, cross ties, and fuel. Yellow birch and sweet birch lumber and veneer that are used in the manufacture of wooden products go principally into furniture, boxes, baskets, crates, woodenware, handles, and millwork such as interior finish and doors. In quantity used, birch ranks fifth among furniture woods, being exceeded by sweetgum, yellow-poplar, maple, and water tupelo (tupelo gum). Plywood made of high-grade yellow birch veneer is being used in increasing quantities in airplane construction. Other important uses for birch are spools, bobbins, and other turned articles.

Large amounts of paper birch are used (chiefly in Maine) for these products, principally the common thread spool, toys, turned boxes, and paper rolls or cores. Sweet and yellow birch are more commonly used for large spools, bobbins, and kitchen woodenware such as turned bowls and bread boards. Small turned handles, dowels, shoe pegs, shoe shanks, and toothpicks are made chiefly of paper birch. Parts of laundry appliances and motor vehicles are generally made of yellow and sweet birch. Birch veneer is generally made from the larger and better quality logs.

Birch is one of the principal woods used for hardwood distillation in the production of wood alcohol, acetate of lime, charcoal, tar, and oils. It is also used for cross ties and in smaller quantities for pulpwood and cooperage. Birch paper pulp is commonly mixed with longer fibered stock from spruce or other conifers in the manufacture of book and similar grades of paper. Birch beer is made from the sap of sweet birch. Oil of birch for flavoring purposes is produced by distilling the bark and twigs of sweet birch.

---

[17] The average weight of paper birch in a thoroughly air-dry condition (12 percent moisture) is 39 pounds per cubic foot.

[18] Six processes are used commercially in making paper pulp from wood. One is the mechanical or ground wood process, in which the wood is reduced to pulp on a grindstone. The yield approaches 100 percent of the weight of the wood. Four are chemical processes—the sulfite, sulfate, soda, and neutral sulfite. They depend upon the dissolving action of chemical reagents which remove essentially all of the binding material (lignin) surrounding the cellulose fibers and leave them in a fairly pure state. The removal of the lignin is accomplished by cooking the wood chips with the proper chemical under steam pressure. The yield of pulp is about one-half the weight of the wood. In a sixth process, the semichemical, part of the lignin is removed by chemical means, and the resultant pulp, containing some lignin, is further refined by mechanical means. The yield of semichemical pulp is intermediate between the yields obtained with the mechanical process and the chemical processes.

Table 1 gives the amounts of birch used in the manufacture of products made wholly or in part of wood in 1912, 1928, 1933, and 1940, including birch in the form of lumber, logs and bolts, and veneer.

TABLE 1—*Birch used in the manufacture of wooden products*

[Thousands of board feet]

Product	1912	1928	1933	1940
Airplanes	----------	285	91	637
Agricultural implements	4, 704	1, 359	89	784
Boot and shoe findings	7, 483	1, 636	1, 255	7, 660
Boxes, baskets, and crating	90, 788	115, 702	[1] 39, 946	[1] 58, 376
Butchers' blocks	[2] 240	[2] 884	[2] 1, 292	82
Car construction and repair	5, 830	883	431	1, 575
Caskets and burial boxes	191	1, 232	1, 216	829
Conduits, pumps and wood pipe	56	154	----------	----------
Dairy, poultry and apiary supplies	(3)	1, 517	829	1, 038
Dowels and skewers	[4] 8, 149	[4] 9, 928	[4] 1, 756	14, 323
Electrical equipment	804	1, 262	276	1, 001
Firearms	----------	419	377	721
Fixtures	15, 255	17, 382	4, 232	8, 674
Flooring	(5)	(5)	3, 446	5, 556
Furniture	84, 791	112, 966	74, 611	102, 624
Handles	12, 352	10, 907	5, 611	23, 074
Instruments, musical	12, 349	7, 679	686	2, 357
Instruments, professional and scientific	1, 062	301	816	357
Ladders	(3)	(3)	203	6
Laundry appliances	3, 876	5, 884	6, 279	14, 177
Machinery	2, 255	1, 558	12	165
Matches	----------	----------	2, 500	1, 935
Patterns and flasks	7	234	36	315
Pencils and penholders	----------	55	40	----------
Pipes, tobacco	2	----------	----------	----------
Playground equipment	148	100	1	23
Plumbers' woodwork	2, 405	6, 961	1, 788	5, 276
Printing material	242	260	100	35
Radio and phonograph cabinets	(6)	(6)	1, 942	2, 502
Refrigerators	[7] 3, 628	[7] 472	1, 752	190
Rollers, shade and map	93	1, 663	133	1, 230
Sash, doors, general millwork	[8] 137, 302	[8] 123, 592	[9] 8, 392	[9] 13, 473
Sewing machines	206	144	95	456
Ship and boat building	1, 055	307	32	79
Shuttles, spools, bobbins, looms	[10] 33, 192	[10] 23, 821	[10] 19, 180	16, 614
Signs, scenery, displays	----------	156	60	50
Sporting and athletic goods	983	1, 311	125	871
Surgical supplies	353	61	----------	495
Tanks	----------	5	----------	----------
Toothpicks	3, 575	7, 483	500	3, 585
Toys	3, 124	5, 748	4, 020	7, 444
Trunks and valises	72	103	22	189
Vehicles, motor	(11)	2, 227	1, 380	7, 703
Vehicles, nonmotor	14, 227	25, 569	431	734
Venetian blinds	(5)	(5)	(5)	----------
Woodenware and novelties	30, 495	33, 020	19, 982	44, 106
Total	481, 294	525, 230	205, 965	351, 321

---

[1] Figures for 1933 and 1940 include birch used for boxes and crates by plants not classified as manufacturers of wooden products and which were not included in 1912 and 1928. The amounts included for nonmanufacturers of wooden products were as follows: For 1933—3,908,000; 1940—1,983,000.

[2] Includes skewers.

[3] Included in "Woodenware and novelties."

[4] Dowels only; skewers included in "Butchers' blocks."

[5] Included in "Sash, doors, general millwork."

[6] Included in "Furniture."

[7] Includes kitchen cabinets.

[8] Includes planing-mill products such as siding, ceiling, and flooring.

[9] Planing-mill products not included in 1933 and 1940 canvasses as in 1912 and 1928, except flooring, which is listed separately.

[10] Does not include looms.

[11] Included in "Vehicles, nonmotor."

REFERENCES

CARE AND IMPROVEMENT OF THE FARM WOODS. C. R. TILLOTSON. U. S. Dept. Agr. Farmers' Bul. 1177, 25 pp., illus. 1920.

FOREST AREAS AND TIMBER VOLUMES IN THE LAKE STATES. R. N. CUNNINGHAM and H. C. MOSER. U. S. Forest Serv., Lakes States Forest Expt. Sta. Rpt., 84 pp., illus. 1938.

LUMBER USED IN MANUFACTURE—1928, 1933, AND 1940. (Summary tables) U. S. Forest Serv. Preliminary Statistics—Forest Survey of the United States.

LUMBER USED IN THE MANUFACTURE OF WOODEN PRODUCTS. J. C. NELLIS. U. S. Dept. Agr. Bul. 605, 18 pp., illus. 1918.

PAPER BIRCH IN THE NORTHEAST. S. T. DANA. U. S. Forest Serv. Cir. 163, 37 pp., illus. 1909.

STRENGTH AND RELATED PROPERTIES OF WOODS GROWN IN THE UNITED STATES. L. J. MARKWARDT and T. R. C. WILSON. U. S. Dept. Agr. Tech. Bul. 479, 99 pp., illus. 1935.

USES OF COMMERCIAL WOODS OF THE UNITED STATES. BEECH, BIRCHES AND MAPLES. H. MAXWELL. U. S. Dept. Agr. Bul. 12, 56 pp. 1913.

U. S. GOVERNMENT PRINTING OFFICE: 1945